



DSA – 210

I Year B.Sc. Degree Examination, Sept./Oct. 2012

Directorate of Distance Education

PHYSICS

Paper – I : Mechanics, Properties of Matter, Heat and Thermodynamics

Time : 3 Hours

Max. Marks : 75/85

- Instructions:** 1) Students who have attended **25 marks IA** scheme will have to answer for total of **75** marks.
2) Students who have attended **15 marks IA** scheme will have to answer for total of **85** marks.
3) Section **E** is **compulsory** for **85** marks scheme only.

SECTION – A

- I. Answer **ALL** questions : **(10×1=10)**
- 1) Define coefficient of restitution.
 - 2) Why rain drops assume spherical shape only while falling down ?
 - 3) How many degrees of freedom does a oxygen molecule possess ?
 - 4) Expand INSAT.
 - 5) Define radiation pressure.
 - 6) Write Newton's law of gravitation in vector form.
 - 7) Define vector product of two vectors.
 - 8) State second law of thermodynamics.
 - 9) What is pseudo force ?
 - 10) What is stream line motion ?

SECTION – B

- II. Answer **any FIVE** questions : **(5×3=15)**
- 11) Write a brief note on multi-stage rockets.
 - 12) State the law of conservation of angular momentum. Show that in central motion areal velocity remains constant.
 - 13) Distinguish the real gas and perfect gas.

P.T.O.



- 14) State and prove the theorem of parallel axes.
- 15) State the law of equipartition of energy. Find 'γ' for a diatomic molecule.
- 16) State and explain the Galilean principle of relativity.
- 17) Explain with a diagram the distribution of energy in the spectrum of blackbody radiation.

SECTION – C

III. Answer **any FIVE** questions.

(5×6=30)

- 18) Starting from Planck's law of radiation deduce :
 - i) Wien's displacement law and
 - ii) Rayleigh - Jean's law.
- 19) Define bending moment. Give the theory of single cantilever.
- 20) Write Galilean transformation equations. Show that a frame moving with a uniform velocity relative to an inertial frame is also an inertial frame.
- 21) What is centre of mass frame ? Derive an expression for instantaneous velocity of a rocket taking into account the effect of gravity.
- 22) What is an adiabatic process ? Derive P, V, T relations for an adiabatic change.
- 23) With a neat diagram, describe Joule-Thomson Porous plug experiment, and discuss the experimental results.
- 24) Deduce the expression for coefficient of viscosity of a liquid by Poiseuille's capillary flow method.

SECTION – D

IV. Answer **any TWO** questions :

(2×10=20)

- 25) a) Derive an expressions for radial and transverse components of velocity and acceleration of a particle moving in a plane.
 - b) Find the torque about the point $(1\hat{i} + 2\hat{j} - 1\hat{k})$ of a force represented by $(3\hat{i} + \hat{k})$ acting through the point $(2\hat{i} + \hat{j} - 3\hat{k})$.

(7+3)



- 26) a) Derive an expression for efficiency of a Carnot's engine in terms of temperature of source and sink by explaining the various stages of the cycle.
- b) The efficiency of a Carnot's engine is 25%. When the temperature of the sink is 300 K, by how much should the temperature of source be increased for the efficiency to become 50%. **(7+3)**
- 27) a) Define moment of inertia and radius of gyration. Derive an expression for moment of inertia of a rectangular plate about an axis passing through its centre and perpendicular to its plane.
- b) A steel wire of 1 mm radius is bent in the form of a circular arc of radius 50 cms. Calculate the bending moment. (Given Young's modulus for steel = 20×10^{10} N/m²). **(7+3)**
- 28) a) Derive Clausius and Clapeyron latent heat equation and discuss the effect of pressure on melting point and boiling point.
- b) Calculate the change in entropy when 50 grams of ice at 273 K melts into water at 300 K. Assume latent heat of ice to be 3.36×10^5 J/Kg and specific heat capacity of water to be 4200 J/Kg K⁻¹. **(7+3)**

SECTION – E

V. Answer **any ONE** of the following questions : **(1×10=10)**

(Compulsory question for 85 marks scheme only)

- 29) a) State Kepler's laws of planetary motion.
- b) Hence derive second and third law of Kepler from Newton's law of gravitation. **(3+7)**
- 30) a) What is compound pendulum ? Derive an expression for period of oscillation of a compound pendulum.
- b) Derive an expression for elastic potential energy. **(6+4)**